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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

Log Event A

Borehole 50-09-02

Borehole Information

Farm :	T	**Tank :**	T-109	**Site Number :**	299-W10-166
N-Coord :	43,461	**W-Coord :**	75,789	**TOC Elevation :**	671.26
Water Level, ft :	83.7	**Date Drilled :**	6/30/1975		

Casing Record

Type :	Steel-welded	Thickness, in. :	0.280	ID, in. :	6
Top Depth, ft. :	0	Bottom Depth, ft. :	122		
Type :	Steel-welded	Thickness, in. :	0.330	ID, in. :	8
Top Depth, ft. :	0	Bottom Depth, ft. :	82		

Borehole Notes:

Borehole 50-09-02 was drilled in June 1975 to a depth of 122 ft. The drilling log indicates that an 8-in. borehole was drilled to 85 ft and a 6-in. borehole was drilled from 85 to 122 ft. The bottom 20 ft of the borehole was grouted with eight sacks of cement. The 6-in. casing was then perforated from 92 to 101 ft and the borehole was grouted with five sacks of cement. The concrete apparently set-up inside the casing because it was necessary to drill concrete out of the casing from 76 to 89 ft.

Observations made during the logging operations do not indicate that there is more than one casing in this borehole. On the basis of the information provided in the drilling log, it appears that a second casing is likely.

The top of the 6-in. casing, which is the zero reference for the SGLS, is approximately even with the ground surface.

Equipment Information

Logging System :	2B	**Detector Type :**	HPGe	**Detector Efficiency:**	35.0 %
Calibration Date :	10/1997	**Calibration Reference :**	GJO-HAN-14	**Logging Procedure :**	MAC-VZCP 1.7.10-1

Logging Information

Log Run Number :	1	**Log Run Date :**	01/09/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	0.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	2.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Log Run Number :	3	**Log Run Date :**	01/13/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	86.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	39.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	4	**Log Run Date :**	01/14/1998	**Logging Engineer:**	Gary Lekvold
Start Depth, ft.:	40.0	**Counting Time, sec.:**	200	**L/R :** L	**Shield :** N
Finish Depth, ft. :	28.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

Borehole 50-09-02 was logged in four runs. The total logging depth achieved by the SGLS was 86 ft. Spectra were collected at intervals of 0.5 ft using a 200-s counting time.

There was water in the borehole at a depth of 83.7 ft at the time of logging.

Analysis Information

Analyst : D.L. Parker

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 05/22/1998

Analysis Notes :

The pre-survey and post-survey field verification for each logging run met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from the field verification spectrum that most closely matched the field data were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra.

A casing correction factor for a 0.50-in.-thick steel casing was applied to calculate the radionuclide concentration data during the analysis process. Although this correction factor does not match actual field conditions, of the casing correction factors currently available, it most closely matches actual field conditions. Use of this casing correction factor will cause radionuclide concentrations to be undercalculated.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the apparent concentrations. Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

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A time-sequence plot of the historical gross gamma log data from 1980 to 1988 is presented with the SGLS log plots.

Results/Interpretations:

The man-made radionuclides Cs-137, Co-60, Eu-154, and Eu-152 were detected by the SGLS. The Cs-137 contamination was detected only in the upper 33 ft of the borehole. Cs-137 was detected almost continuously from the ground surface to 19.5 ft and 23.5 to 33 ft. The maximum Cs-137 concentration was detected at 2.5 ft with an apparent concentration of 7.3 pCi/g.

Co-60 contamination was detected continuously from 64 ft to the bottom of the logged interval (86 ft). The maximum apparent Co-60 concentration of 92.5 pCi/g was recorded at 77 ft.

Eu-154 was detected almost continuously from 63.5 to 80.5 ft. Distinct peaks in the Eu-154 concentrations occur at about 66, 72, and 77 ft. The maximum apparent Eu-154 concentration of 55.9 pCi/g was measured at 66 ft.

Eu-152 contamination was detected intermittently from 65 to 72.5 ft with a maximum apparent concentration of 1.25 pCi/g measured at a depth of 65.5 ft.

Apparent K-40 concentrations are relatively constant at about 9 pCi/g from about 1 to 37 ft and then increase slightly to about 11 pCi/g below about 38 ft.

It was not possible to identify most of the 609-keV peaks below a depth of 63.5 ft. These peaks are used to calculate the U-238 concentrations for much of the borehole.